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CENTRAL INTELLIGENCE AGENCY

WASHINGTON, D.C. 20505

12 August 1976

MEMORANDUM FOR: The Director of Central Intelligence

FROM : William W. Wells
Deputy Director for Operations

SUBJECT : MILITARY THOUGHT (USSR): Determining the
Balance of Forces in Ground Forces Large
Units in an Operation

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". This article proceeds from the premise that in establishing the balance of forces of two sides, there must be determined coefficients of commensurability which take into account qualitative differences in equipment and their cooperation with each other, as well as quantitative composition. A meeting engagement between a Soviet division and divisions of various enemy countries is taken as a model, comparing motorized rifle and tank divisions with and without incorporating the means of control. Coefficients also are obtained for several variants of reinforcement. This article appeared in Issue No. 1 (83) for 1968.

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2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies. For ease of reference, reports from this publication have been assigned the

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Intelligence Information Special Report

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COUNTRY USSR

DATE OF
INFO. Early 1968

DATE 12 August 1976

SUBJECT

MILITARY THOUGHT (USSR): Determining the Balance of
Forces in Ground Forces Large
Units in an Operation

SOURCE Documentary

Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 1 (83) for 1968 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The authors of this article are General-Mayor (Retired) G. Perventsev and Engineer Major D. Sokolov. This article proceeds from the premise that in establishing the balance of forces of two sides, there must be determined coefficients of commensurability which take into account qualitative differences in equipment and their cooperation with each other, as well as quantitative composition. A meeting engagement between a Soviet division and divisions of various enemy countries is taken as a model, comparing motorized rifle and tank divisions with and without incorporating the means of control. Coefficients also are obtained for several variants of reinforcement. Four tables, a graph and calculations are provided as illustration.

End of Summary

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Determining the Balance of Forces in Ground Forces
Large Units in an Operation

by
General-Mayor (Retired) G. Perventsev
and
Engineer Major D. Sokolov

Calculations of the balance of forces and means of two sides will constitute, as is known, an extremely important element in the assessment of a situation. They are essential to the adoption of a sound decision.

In the practical activity of staffs of all levels, the balance of forces appears most often in the form of a set of individual balances, the analysis of which is a difficult task and cannot produce a simple determination of the superiority of one side over the other. For example, given a balance of 1:1.1 in divisions, 2:1 in tanks, 1:3 in artillery over 100-mm caliber, 1.5:1 in artillery under 100-mm caliber, 1:1.3 in delivery means for nuclear weapons, 1:2.4 in antitank guided missiles, 2:1 in mortars, and 1:1.2 in personnel, it is impossible without additional calculations to establish which of the two groupings is stronger and by how much.

It is quite obvious that along with the quantitative composition of the two sides, it is very important to take into account the qualitative differences among weapons of the same kind (missiles, tanks, mortars, and others); for example, differences in range of fire, effectiveness, armored protection of systems, rate of fire of weapons, etc. When comparing large units of ground forces we should bear in mind the difference in the number of personnel, and in the amount and tactical-technical characteristics of the combat equipment.

And so, three tasks arise:

1. To work out a simple assessment of the balance of forces and means of groupings of ground forces.

2. To account for the qualitative differences in the co^{50X1}-HUM means of the two sides.

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3. To establish a method for accomplishing the first two tasks, so that the results obtained will be convenient for use in operational staffs.

The first task may be accomplished in various ways, for example, by seeking relationships between individual balances for types of combat equipment and the overall balance of ground forces, or by determining a common criterion which would automatically include all balances.

The advantage of the first method lies in the fact that individual balances are determined easily from the quantitative composition of opposing groupings, while the disadvantage lies in the complexity of the relationships among individual balances. The determination of these relationships requires that not only the "weight" of the individual balances in the overall balance, but also their mutual effect upon each other, be taken into account.

The second method is appealing for its simplicity and clarity but is distinguished by the difficulty of finding a common criterion. Combat means may be compared only when they fulfil similar tasks, that is when there exists an identical criterion for assessing the result of their actions. It is possible to compare artillery guns of different caliber, various types of tanks, and so forth, but it is extremely difficult to find a satisfactory criterion for comparing, for example, a mortar and an antitank guided missile, or a tank and an aircraft. On the other hand it must be borne in mind that the objects taken as units of measurement must be present in the large units of both sides. For example, subunits of nuclear artillery cannot serve as a unit of measurement if one side does not have them. It is obvious, too, that when calculating the effect of various types of combat equipment on each other, the unit of measurement must include the basic types of weapons used in the combat actions.

Taking all these requirements into account, we have come to the conclusion that even now one of the units of measurement can be a ground forces division. It is the typical level to be found in the structure of the armed forces of every country, without exception. It contains almost all types of conventional weapons, as well as nuclear weapons. Battle formations of large units and

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their actions are determined by the appropriate regulations and, with a few assumptions, may be standardized. On the other hand, the number of basic types of divisions is limited in the case of the ground forces to three types: motorized rifle (mechanized, infantry, and motorized infantry), tank (armored), and airborne. During the conduct of an operation these types of divisions will wage battles against any of the analogous types of enemy divisions.

If we consider that both sides possess divisions of approximately the same type, then the balance of forces looks like

$$K_c^1 = \frac{n_1 N_1}{m_1 M_1}$$

where n_1 , m_1 represent the coefficients of commensurability of the combat capabilities of the divisions of the two sides N and M to a "standard" division chosen as a unit of measurement; and N_1 , M_1 represent the number of divisions of the first type belonging to the two sides N and M, respectively.

In this case, if we take as the "standard" division a division from side N, then

$$K_c^1 = \frac{1}{m_1} \cdot \frac{N_1}{M_1},$$

where $\frac{N_1}{M_1}$ represents the balance between the number of divisions. In our example each side has three types of divisions; therefore, the balance takes the form

$$K_c^{111} = \frac{N_1 + \frac{n_2}{n_1} N_2 + \frac{n_3}{n_1} N_3}{\frac{m_1}{n_1} M_1 + \frac{m_2}{n_1} M_2 + \frac{m_3}{n_1} M_3}.$$

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Thus, to determine the balance K_c we have to find a relative "value" of the divisions of each type for both sides; that is, determine the coefficient of commensurability $\frac{n_2}{n_1} \cdot \frac{m_1}{n_1} \cdot \frac{m_2}{n_1}$, etc. and obtain the number of large units of our troops and of the enemy from operational information.

But earlier we established that when determining coefficients of commensurability it is very important to take into account not only the composition of combat means, but also the difference in their tactical-technical characteristics. Qualitative indices are revealed most clearly in a combat situation where a major role is played not only by fire, but also by such factors as mobility, speed of movement, the control system, etc. In addition, cooperation is carried out in a battle among various combat means, that is, mutual influence is exerted on the effectiveness of action against the enemy, and a shortage in one type of weapon is made up for by the prevalence of another type. This kind of cooperation is not static, but changes as the battle situation changes. The latter depends not only on the actions of our troops, but also on the counteraction by the enemy.

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A model of the combat of two groupings of ground forces during a meeting engagement can serve as a mathematical representation of this process. Since we must make a comparative assessment of the divisions of the Soviet Army and those of our probable enemies, the model must represent a battle between two divisions.

An important role in a battle is played by dependable and continuous troop control, which depends on the availability and the tactical-technical characteristics of communications means, especially radio means. But inasmuch as indices of the condition of control means are not directly included in the assessment of the balance of forces, their impact on the course of the battle may be expressed in terms of an increase in losses to both sides as a result of the disruption of control.

On the basis of the principles set forth, a mathematical model of a meeting engagement between two large units of ground forces was developed, and a number of coefficients were also calculated. The model takes into account the number and

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tactical-technical characteristics of weapons, and does not include personnel not belonging to crews of weapons systems since their number is approximately equal on both sides if servicing subunits are not considered.

In the calculations the following were accepted as the possible number of nuclear warheads:

-- separate missile battalion -- three warheads with a yield of 20 kilotons each;

-- Lance or Honest John battalion -- four warheads with a yield of 50 kilotons each;

-- 203.2mm howitzer battery -- four warheads with a yield of 1.5 kilotons each;

-- Davy Crockett guns -- one warhead with a yield of 0.02 kilotons each.

In the process of solving this problem, a comparison was made between a motorized rifle division of ours and analogous large units of the US, West Germany, Great Britain, Belgium, The Netherlands, and other countries, as well as between a tank division of our troops and an armored division of the US, a tank division of West Germany, and a division of Great Britain.

The amount of combat means in divisions of the Soviet Army and in the divisions of the probable enemy (US, West Germany, Great Britain, Belgium, The Netherlands) was taken from wartime tables of organization and equipment, which were also used in the calculations.

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The results of the solution to the problem are shown in Tables 1 and 2. The values of the coefficients are valid for the given tables of organization and equipment for large units during wartime. If the amount of combat means changes or new types of weapons are introduced, the coefficients of commensurability must be recomputed.

Table 1 shows the coefficients of commensurability for motorized rifle, mechanized, and motorized infantry divisions with different variants of organic missile/nuclear weapons and

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for two variants of the solution to the problem: when the effect of radio means of control on the course of the battle is not taken into account, and when it is taken into account. In the former case it is assumed that information is transmitted immediately at any level of control.

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Coefficients of a Comparative Assessment of Motorized Rifle, Mechanized and Motorized Infantry Large Units of the Ground Forces

Table 1

Name of Large Unit	Motorized Rifle Division of the USSR		Mechanized Division of the USSR		Motorized Infantry Division of West Germany		Division of Great Britain		Mechanized Division of Belgium		Infantry Division of The Netherlands	
Type of Missile	R-30	R-70	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE
Motorized Rifle Division of the USSR (R-30)	1.00	1.15	0.95	--	1.25	--	0.80	--	0.92	--	0.40	--
Motorized Rifle Division of the USSR (R-70)	0.87	1.00	0.85	1.17	1.03	--	0.77	0.92	0.75	--	0.35	0.47
Motorized Rifle Division of the USSR (R-30)	1.00	1.10	1.05	--	1.55	--	0.87	--	0.97	--	0.45	--
Motorized Rifle Division of the USSR (R-70)	0.90	1.00	1.03	1.29	1.38	1.60	0.80	0.97	0.80	1.20	0.40	0.50

Without Taking Communications Means into Account

Taking Communications Means into Account

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In using the table, the unit of measurement is taken to be a motorized rifle division of our troops which has one of the types of missiles (R-30 or R-70) in service. If a division with R-70 missiles is used, large units armed with R-30 missiles have a coefficient of 0.87 when communications means are not considered, and 0.90 when they are. For the large units of the probable enemies, coefficients are chosen that correspond to the type of missiles found in the given division. Using the table it is possible to calculate the balance of forces of the two sides in motorized rifle divisions, while taking into account the combat capabilities of each large unit, in the following manner. Large units of a country are chosen that have the identical type of missiles in service, and the number of them is multiplied by the appropriate coefficient. Then the same calculation is made for divisions with other types of missiles and for divisions of other countries that are located in the zone under consideration (zone of an army or front, or in the theater of military operations). The products obtained are added together and the sum gives the number of one country's divisions, with their quality taken into consideration. By dividing this number by an analogous number found for another country, we may obtain the balance for motorized rifle divisions.

Let us illustrate the above with an example. Let us assume that a front contains three motorized rifle divisions with R-30 missiles and 15 motorized rifle divisions with R-70 missiles. The calculation will be made taking communications means into account and taking as the unit of measurement a motorized rifle division with R-70 missiles.

On the enemy side, two US mechanized divisions with Lance missiles, three West German motorized infantry divisions with Honest John missiles, one British division, and two Belgian mechanized divisions with Lance missiles are operating in the zone of the front.

Then

$$K = \frac{1.29 \cdot 2 + 1.38 \cdot 3 + 0.97 \cdot 1 + 1.20 \cdot 2}{0.90 \cdot 3 + 1 \cdot 15} = \frac{10.09}{17.7} .$$

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Thus, the balance for motorized rifle divisions is 1.75:1 in our favor. At the same time the balance solely for the number of divisions without regard to their quality is 2.25:1.

From Table 1 it is clear that the greatest coefficient of commensurability (1.55) is possessed by the West German motorized infantry division. This is due to the presence of six launchers in a missile battalion and a large concentration of antitank means in the battle formations (2,904).

The latter considerably weakens the effect on the enemy of our tank battalions, which constitute the main striking force of a motorized rifle division. The relatively high coefficient for the Belgian mechanized division is due to the large concentration of hand-held antitank weapons in the battle formations.

To illustrate the role of antitank means, we present a graph showing tank losses in a division armed with R-70 missiles in a battle with a US mechanized division, based on the results of the modeling of a meeting engagement between them on an electronic computer. The graph shows the percentage of tanks which remained in the motorized rifle division (Curve No. 1) and the percentage of enemy antitank means which were not destroyed (Curve No. 2), depending on the distance between the battle formations of the two sides (d). On Curve No. 1, points 1 and 2 delineate the range of losses from strikes by enemy nuclear means. At point 3 the effect on tanks of antitank guided missiles begins to be shown, and at point 4 also that of enemy antitank rocket launchers. On Curve No. 2, point 11 represents the beginning of artillery action, while point 12 shows the effect of mortars on the enemy's system of antitank defense. Point 13 represents the beginning of fire by the tanks of the motorized rifle division of the USSR.

From the graph it is clear that the main losses of tanks are caused by antitank guided missiles and antitank rocket launchers.

Table 2 gives the coefficients of comparative assessment for tank divisions. The principle behind this table is analogous to that of the previous one, and calculation of the balance for tank divisions using this table is carried out the same way.

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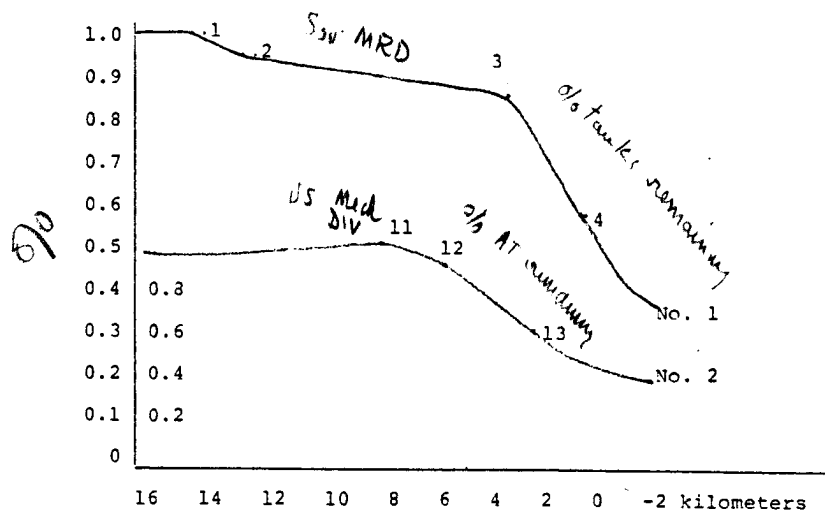
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Table 2

Coefficients of Comparative Assessment for Tank Large
Units of the Ground Forces

Name of Large Unit	Tank Division of the USSR		Armored Division of the US		Tank Division of West Germany		Division of Great Britain	
Type of Missile	R-30	R-70	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE
Without Taking Communications Means into Account								
Tank Division of the USSR (R-30)	1.00	1.19	1.47	--	1.33	--	0.78	--
Tank Division of the USSR (R-70)	0.84	1.00	1.05	1.28	1.11	1.22	0.70	0.82
Taking Communications Means into Account								
Tank Division of the USSR (R-30)	1.00	1.10	1.51	--	1.48	--	0.85	--
Tank Division of the USSR (R-70)	0.90	1.00	1.20	1.38	1.30	1.43	0.80	0.90



Graph of relative losses of tanks and antitank means

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The high coefficients of the combat capabilities of the US armored division are due to its possession of a large number of antitank means and Davy Crockett guns with nuclear warheads, for the neutralization of which a unit of artillery and mortars must be allocated. The high coefficient of the West German tank division is due to the presence of six launchers per missile battalion, as well as to the large number of panzerfausts and antitank guided missiles.

In view of the fact that when conducting an operation with ground forces, it is assumed that motorized rifle and tank large units are reinforced with artillery units, and sometimes with missile units and subunits as well, coefficients were determined for the combat capabilities of reinforced divisions of the Soviet Army. We have examined the following variants of reinforcement:

a) for a motorized rifle division:

- 1) two 122-mm howitzer battalions -- 36 guns,
two 152-mm gun-howitzer battalions -- 24 guns;
- 2) two 152-mm gun-howitzer battalions -- 24 guns,
one 240-mm mortar battalion -- 12 guns,
one battalion of BM-24 rocket launcher
vehicles -- 12 vehicles;
- 3) three 152-mm gun-howitzer battalions -- 36 guns,
three 130-mm gun battalions -- 54 guns;
- 4) two 152-mm gun-howitzer battalions -- 24 guns,
one 100-mm antitank gun battalion -- 24 guns,
nine antitank guided missiles;
- 5) one R-70 missile battalion -- three launchers;

b) for a tank division;

- 1) one 130-mm gun battalion -- 18 guns,
one 240-mm mortar battalion -- 12 guns;
- 2) one R-70 missile battalion -- three launchers,

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- 3) two 122-mm howitzer battalions -- 36 guns,
one battalion of BM-24 rocket launcher vehicles
-- 12 vehicles.

For each variant of reinforcement, coefficients of comparative assessment with US and West German divisions were obtained. By dividing the corresponding values from Tables 1 and 2 by the newly obtained values, coefficients comparing reinforced divisions of the Soviet Army and divisions that were not reinforced were determined. These coefficients appear in Table 3 and show how many times the combat capabilities of reinforced motorized rifle and tank large units are increased. Here it was assumed that our large units are armed with R-70 missiles.

Table 3
Coefficients of Comparative Assessment for Reinforced
Divisions of the Soviet Army

Type of Division	Motorized Rifle Division					Tank Division		
Variant of Reinforcement	1	2	3	4	5	1	2	3
Value of coefficient without taking communications means into account	1.05	1.20	1.27	1.11	1.11	1.35	1.16	1.12
Value of coefficient taking communications means into account	1.06	1.29	1.33	1.20	1.20	1.38	1.13	1.14

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From Table 3 it is clear that divisions reinforced with 130-mm gun battalions have the highest coefficient. This is because of the great range of these guns, which makes it possible to neutralize the nuclear artillery of the divisions of probable enemies before it is able to deliver a strike against our troops. In addition, the use of 240-mm mortars and BM-24 rocket launcher vehicles, which are extremely effective in combat against the antitank means found in the battle formations of enemy battalions, has a considerable effect on increasing the coefficient of comparison.

Using the tables given, it is not difficult to assess the balance of forces of ground troops in the zone of a front. Let us assume that ground forces of our grouping and the opposing enemy have at their disposal the forces shown in Table 4.

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Table 4
Our Troops

Type of Missile Armament	R-30	R-70	R-70	R-70	R-70	Total
Variant of Reinforcement	None	None	1	3	5	
Motorized Rifle Division	6	5	2	2	1	16
Tank Division	--	6	5	--	--	11

The Enemy

Country	United States		Great Britain		West Germany		Belgium		The Netherlands		Total
Type of Missile Armament	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE	HONEST JOHN	LANCE	
Mechanized Division (Motorized Infantry Division)	--	2	4	--	3	3	2	--	2	--	16
Tank Division (Armored Division)	--	1	--	--	1	1	--	--	--	--	3

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We compute the number of motorized rifle divisions, taking into account their quality and communications means, by using Tables 1 and 3:

KR-30	=	6·0.90	=	5.40
KR-70	=	5·1.00	=	5.00
KR-70/3	=	2·1.33	=	2.66*
KR-70/1	=	2·1.06	=	2.12
KR-70/5	=	1·1.20	=	1.20

Total 16.38

We compute the number of enemy mechanized divisions (motorized infantry divisions), taking into account their quality and communications means, by using the data in Table 3:

K _{HJ}	(Great Britain)	=	4·0.80	=	3.20
K _L	(West Germany)	=	3·1.60	=	4.80
K _{HJ}	(West Germany)	=	3·1.38	=	4.14
K _{HJ}	(Belgium)	=	2·0.80	=	1.60
K _{HJ}	(The Netherlands)	=	2·0.40	=	0.80
K _L	(US)	=	2·1.29	=	2.58

Total 17.12

*The number after the slash refers to the variant of reinforcement.

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Then the balance for motorized rifle divisions is $\frac{17.12}{16.38} = 1.04:1$ in favor of the enemy.

In calculating the balance for tank divisions, we take as the unit of measurement a tank division of the USSR with R-70 missiles and take communications means into account. Using Tables 2 and 3 we get:

$$\begin{array}{rcl} K_{TD} (R-70) & = & 6 \cdot 1.00 = 6.00 \\ K_{TD} (R-70/1) & = & 5 \cdot 1.38 = 6.90 \\ \hline \text{Total} & & 12.90 \end{array}$$

For enemy tank divisions:

$$\begin{array}{rcl} K_L & (US) & = 1 \cdot 1.38 = 1.38 \\ K_{HJ} & (West Germany) & = 1 \cdot 1.30 = 1.30 \\ K_L & (West Germany) & = 1 \cdot 1.43 = 1.43 \\ \hline \text{Total} & & 4.11 \end{array}$$

$$\text{Then } K_{TD} = \frac{12.90}{4.11} = 3.11:1 \text{ in our favor.}$$

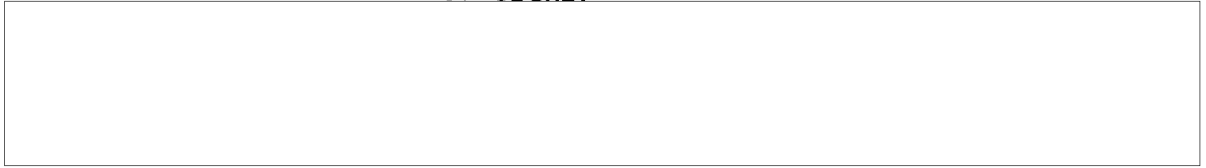
Thus, the coefficients of comparative assessment obtained for large units of ground forces enable us to make a comprehensive assessment of the forces of the two sides, taking into account various means of reinforcement and weapons systems.

In those cases where the composition of the large units differs from their initial composition, which is typical of active combat actions, the coefficient of comparative combat capabilities must be multiplied by a corrective coefficient from specialized tables or nomograms of such coefficients.

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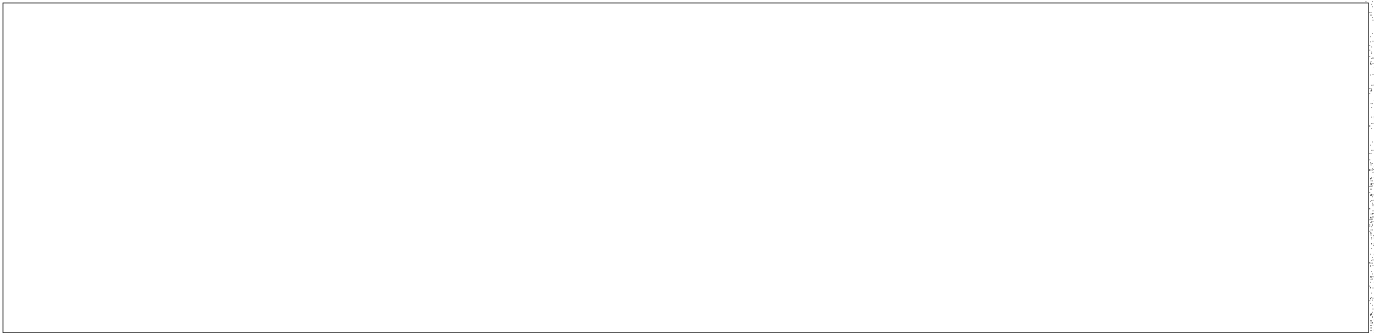
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The above tables of coefficients of comparative assessment for large units of ground forces will help staff officers compute a balance of forces taking the quantitative and qualitative composition of opposing forces into consideration.

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